MULTIMEDIA UNIVERSITY

STUDENT IDENTIFICATION NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2016/2017

BOM2064 – QUALITY AND OPERATIONS MANAGEMENT

(All Sections / Groups)

27 FEBRUARY 2017

9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of 8 pages with **FOUR** (4) questions only. Relevant equations and normal distribution tables are provided in the Appendix.

2. Answer **ALL** questions. The distribution of the marks for each question is given at the end of each question.

3. Please write all your answers in the answer booklet provided.

QUESTION 1

a) Companies must be competitive to sell their goods and services in the marketplace. Competitiveness is an important factor in determining whether a company prospers, barely gets by, or fails. Explain **FIVE (5)** different types of operation strategies, with examples of companies, which help the companies to stay competitive in the marketplace.

(10 marks)

b) A company manufactures an electronic device to be used in a very wide temperature range. The company knows that increased temperature shortens the life time of the device, and a study is therefore performed in which the life time is determined as a function of temperature. The following data is found:

Temperature in Celcius	10	20	30	40	50	60	70	80	90
Life time in hours	420	365	285	220	176	117	69	34	5

i) Construct a scatter diagram to illustrate the figures.

(2 marks)

ii) Determine the linear regression equation for the data.

(9 marks)

iii) Calculate the correlation coefficient. Explain the relationship between these variables.

(2 marks)

iv) Estimate the life time of the electronic device if the temperature would have to be set at 65 in Celcius.

(2 marks)

(Total: 25 marks)

Continued...

QUESTION 2

a) Organizations that operate globally are discovering advantages in global product design that increases the marketability and utility of a product. Discuss the **THREE (3)** categories of companies that perform global product design and provide **ONE (1)** example of company for each category.

(10 marks)

b) There are a number of tools that an organization can use for problem solving and process improvement. Discuss and evaluate the **SEVEN (7)** basic quality tools used by organizations. Propose which of the seven tools will be most appropriate for identifying the relationship between age and absenteeism rate in a workplace.

(15 marks)

(Total: 25 marks)

QUESTION 3

a) Energoger Battery has recently been receiving complaints from retailers that its batteries are not as lasting as their competitors. Therefore, Noel Wan, the head of Quality Control in Energoger Battery decided to set up hourly assembly line checks. Previously, the batteries have had an average life of 50 hours, about 10% longer than competitors' batteries. Noel Wan took size-5 samples of batteries for each of the 25 hours to establish the standards for control chart limits. Those 25 samples are shown in the following table:

Continued...

Hour	Observations (Battery life, hours)				
	1	2	3	4	5
1	51	50	49	50	50
2	45	47	70	46	36
3	50	35	48	39	47
4	55	70	50	30	51
5	49	38	64	36	47
6	59	62	40	54	64
7	36	33	49	48	56
8	50	67	53	43	40
9	44	52	46	47	44
10	70	45	50	47	41
11	57	54	62	45	36
12	56	54	47	42	62
13	40	70	58	45	44
14	52	58	40	52	46
15	57	42	52	58	59
16	62	49	42	33	55
17	40	39	49	59	48
18	64	50	42	57	50
19	58	53	52	48	50
20	60	50	41	41	50
21	52	47	48	58	40
22	55	40	56	49	45
23	47	48	50	50	48
24	50	50	49	51	51
25	51	50	51	51	62

Calculate the sample means and range, and the upper and lower control limits of mean and range for the first 25 hours. (**Note**: Write your answers in nearest **TWO decimals**).

(15 marks)

b) Food served at a restaurant should be between 39°C and 49°C when it is delivered to the customer. The process that keeps the food at the correct temperature has a process standard deviation of 2°C and the mean value for these temperature is 40. What is the process capability (C_p) of this process?

(4 marks)

Continued...

c) One of the techniques to monitor inventory is through Radio Frequency Identification (RFID). Explain **THREE (3)** importance of RFID with an example in the hypermarket.

(6 marks)

(Total: 25 marks)

QUESTION 4

a) Ali runs a mango juice shop at Melaka Town. Ali's average demand of mangoes is 95 kg per week. Because of the current economic slowdown, the demand has a high standard deviation of 25 kg per week. Ali is only able to fulfill 65% of all orders and he need 4 days to restock his mangoes from Thailand. Therefore, Ali plans to reduce his risks by making his demand certain and predictable. He plans to limit his use of mangoes to exactly 50 kg every week.

i) What is Ali's current reorder point (ROP)?

(4 marks)

ii) What is Ali's reorder point if his demand is made certain?

(3 marks)

b) Dawson is a newcomer who operates a mini market in the neighbourhood. Due to the lack of experience, he has difficulty managing his inventories effectively and this has caused great losses to the company. So Dawson approached you for advice. Propose to Dawson **FIVE (5)** requirements for effective inventory management.

(10 marks)

c) Ray-ban Eyewear uses a Kanban system. The company has scheduled production of 200 pieces of lenses per hour for a particular sunglasses model. The assembly line requires 96 minutes to fit the lenses before placing them into a container with a capacity of 2 dozen pairs of sunglasses. Once in a while, the lenses break while being fitted in, so the management has allowed a rate of 0.15 for inefficiencies.

i) How many Kanban cards should be authorized?

(5 marks)

ii) Calculate the maximum inventory?

(3 marks)

(Total: 25 marks)

Continued...

RELEVANT EQUATIONS

1) CL = $\overline{\overline{X}}$, $\overline{R}$

UCL, LCL (X – bar) = $\overline{\overline{X}} \pm A_2 \overline{R}$

UCL (R) = $D_4\overline{R}$

LCL (R) = $D_3\overline{R}$

Table for X – bar & R Charts

No of Observation In sub group n	A2	D3	D4
2	1.88	0	3.27
3	1.02	0	2.57
4	0.73	0	2.28
5	0.58	0	2.11
6	0.48	0	2

2) UCL c = $\bar{c} + 3\sqrt{\bar{c}}$

LCL c = $\bar{c} - 3\sqrt{\bar{c}}$

3) $\bar{p}$ = Total No of Defective from All Samples/ (No of Samples X Sample Size)

$Sp = \sqrt{[\bar{p}(1-\bar{p})/n]}$

CL = $\bar{p}$

LCL = $\bar{p} - 3\,Sp$

UCL = $\bar{p} + 3\,Sp$

4) Capacity Utilization = Capacity Used / Best Operating Level

5) $$r = \frac{n\sum XY - [\sum X \sum Y]}{\sqrt{\left[n\sum X^2 - (\sum X)^2\right]\left[n\sum Y^2 - (\sum Y)^2\right]}}$$

$$a = \overline{Y} - b\overline{X}$$

$$b = \frac{n\sum XY - \sum X \sum Y}{n\sum X^2 - (\sum X)^2}$$

Continued...

6) Exponential smoothing

Forecast for the month t: $F_t = F_{t-1} + \alpha(A_{t-1} - F_{t-1})$

7) Inventory Management:

$$\text{EOQ} = Q^* = \sqrt{\frac{2DS}{H}} \qquad TC = \frac{Q}{2}H + \frac{D}{Q}S$$

$$\text{EPQ} = Q_0 = \sqrt{\frac{2DS}{H}}\sqrt{\frac{p}{p-u}} \qquad I_{\max} = \frac{Q}{P}(p-u) \qquad TC = \frac{I_{\max}}{2}H + \frac{D}{Q}S$$

$$SS = z\,(\sigma d)\sqrt{LT} \qquad ROP = \bar{d}\,(LT) + z(\sigma d)\sqrt{LT}$$

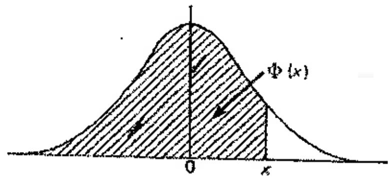
8) Lean Operations:

$$N = \frac{DT(1+X)}{C}$$

Continued...

TABLE 4. THE NORMAL DISTRIBUTION FUNCTION

The function tabulated is $\Phi(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{x} e^{-\frac{1}{2}t^2}\, dt$. $\Phi(x)$ is the probability that a random variable, normally distributed with zero mean and unit variance, will be less than or equal to x. When $x < 0$ use $\Phi(x) = 1 - \Phi(-x)$, as the normal distribution with zero mean and unit variance is symmetric about zero.



x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$
0·00	0·5000	0·40	0·6554	0·80	0·7881	1·20	0·8849	1·60	0·9452	2·00	0·97725
·01	·5040	·41	·6591	·81	·7910	·21	·8869	·61	·9463	·01	·97778
·02	·5080	·42	·6628	·82	·7939	·22	·8888	·62	·9474	·02	·97831
·03	·5120	·43	·6664	·83	·7967	·23	·8907	·63	·9484	·03	·97882
·04	·5160	·44	·6700	·84	·7995	·24	·8925	·64	·9495	·04	·97932
0·05	0·5199	0·45	0·6736	0·85	0·8023	1·25	0·8944	1·65	0·9505	2·05	0·97982
·06	·5239	·46	·6772	·86	·8051	·26	·8962	·66	·9515	·06	·98030
·07	·5279	·47	·6808	·87	·8078	·27	·8980	·67	·9525	·07	·98077
·08	·5319	·48	·6844	·88	·8106	·28	·8997	·68	·9535	·08	·98124
·09	·5359	·49	·6879	·89	·8133	·29	·9015	·69	·9545	·09	·98169
0·10	0·5398	0·50	0·6915	0·90	0·8159	1·30	0·9032	1·70	0·9554	2·10	0·98214
·11	·5438	·51	·6950	·91	·8186	·31	·9049	·71	·9564	·11	·98257
·12	·5478	·52	·6985	·92	·8212	·32	·9066	·72	·9573	·12	·98300
·13	·5517	·53	·7019	·93	·8238	·33	·9082	·73	·9582	·13	·98341
·14	·5557	·54	·7054	·94	·8264	·34	·9099	·74	·9591	·14	·98382
0·15	0·5596	0·55	0·7088	0·95	0·8289	1·35	0·9115	1·75	0·9599	2·15	0·98422
·16	·5636	·56	·7123	·96	·8315	·36	·9131	·76	·9608	·16	·98461
·17	·5675	·57	·7157	·97	·8340	·37	·9147	·77	·9616	·17	·98500
·18	·5714	·58	·7190	·98	·8365	·38	·9162	·78	·9625	·18	·98537
·19	·5753	·59	·7224	·99	·8389	·39	·9177	·79	·9633	·19	·98574
0·20	0·5793	0·60	0·7257	1·00	0·8413	1·40	0·9192	1·80	0·9641	2·20	0·98610
·21	·5832	·61	·7291	·01	·8438	·41	·9207	·81	·9649	·21	·98645
·22	·5871	·62	·7324	·02	·8461	·42	·9222	·82	·9656	·22	·98679
·23	·5910	·63	·7357	·03	·8485	·43	·9236	·83	·9664	·23	·98713
·24	·5948	·64	·7389	·04	·8508	·44	·9251	·84	·9671	·24	·98745
0·25	0·5987	0·65	0·7422	1·05	0·8531	1·45	0·9265	1·85	0·9678	2·25	0·98778
·26	·6026	·66	·7454	·06	·8554	·46	·9279	·86	·9686	·26	·98809
·27	·6064	·67	·7486	·07	·8577	·47	·9292	·87	·9693	·27	·98840
·28	·6103	·68	·7517	·08	·8599	·48	·9306	·88	·9699	·28	·98870
·29	·6141	·69	·7549	·09	·8621	·49	·9319	·89	·9706	·29	·98899
0·30	0·6179	0·70	0·7580	1·10	0·8643	1·50	0·9332	1·90	0·9713	2·30	0·98928
·31	·6217	·71	·7611	·11	·8665	·51	·9345	·91	·9719	·31	·98956
·32	·6255	·72	·7642	·12	·8686	·52	·9357	·92	·9726	·32	·98983
·33	·6293	·73	·7673	·13	·8708	·53	·9370	·93	·9732	·33	·99010
·34	·6331	·74	·7704	·14	·8729	·54	·9382	·94	·9738	·34	·99036
0·35	0·6368	0·75	0·7734	1·15	0·8749	1·55	0·9394	1·95	0·9744	2·35	0·99061
·36	·6406	·76	·7764	·16	·8770	·56	·9406	·96	·9750	·36	·99086
·37	·6443	·77	·7794	·17	·8790	·57	·9418	·97	·9756	·37	·99111
·38	·6480	·78	·7823	·18	·8810	·58	·9429	·98	·9761	·38	·99134
·39	·6517	·79	·7852	·19	·8830	·59	·9441	·99	·9767	·39	·99158
0·40	0·6554	0·80	0·7881	1·20	0·8849	1·60	0·9452	2·00	0·9772	2·40	0·99180

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Continued...

TABLE 4. THE NORMAL DISTRIBUTION FUNCTION

x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$
2·40	0·99180	2·55	0·99461	2·70	0·99653	2·85	0·99781	3·00	0·99865	3·15	0·99918
·41	·99202	·56	·99477	·71	·99664	·86	·99788	·01	·99869	·16	·99921
·42	·99224	·57	·99492	·72	·99674	·87	·99795	·02	·99874	·17	·99924
·43	·99245	·58	·99506	·73	·99683	·88	·99801	·03	·99878	·18	·99926
·44	·99266	·59	·99520	·74	·99693	·89	·99807	·04	·99882	·19	·99929
2·45	0·99286	2·60	0·99534	2·75	0·99702	2·90	0·99813	3·05	0·99886	3·20	0·99931
·46	·99305	·61	·99547	·76	·99711	·91	·99819	·06	·99889	·21	·99934
·47	·99324	·62	·99560	·77	·99720	·92	·99825	·07	·99893	·22	·99936
·48	·99343	·63	·99573	·78	·99728	·93	·99831	·08	·99896	·23	·99938
·49	·99361	·64	·99585	·79	·99736	·94	·99836	·09	·99900	·24	·99940
2·50	0·99379	2·65	0·99598	2·80	0·99744	2·95	0·99841	3·10	0·99903	3·25	0·99942
·51	·99396	·66	·99609	·81	·99752	·96	·99846	·11	·99906	·26	·99944
·52	·99413	·67	·99621	·82	·99760	·97	·99851	·12	·99910	·27	·99946
·53	·99430	·68	·99632	·83	·99767	·98	·99856	·13	·99913	·28	·99948
·54	·99446	·69	·99643	·84	·99774	·99	·99861	·14	·99916	·29	·99950
2·55	0·99461	2·70	0·99653	2·85	0·99781	3·00	0·99865	3·15	0·99918	3·30	0·99952

The critical table below gives on the left the range of values of x for which $\Phi(x)$ takes the value on the right, correct to the last figure given; in critical cases, take the upper of the two values of $\Phi(x)$ indicated.

3·075			0·9994		0·99990		0·99995
	0·9990	3·263		3·731		3·916	
3·105			0·9995		0·99991		0·99996
	0·9991	3·320		3·759		3·976	
3·138			0·9996		0·99992		0·99997
	0·9992	3·389		3·791		4·055	
3·174			0·9997		0·99993		0·99998
	0·9993	3·480		3·826		4·173	
3·215			0·9998		0·99994		0·99999
	0·9994	3·615		3·867		4·417	
			0·9999		0·99995		1·00000

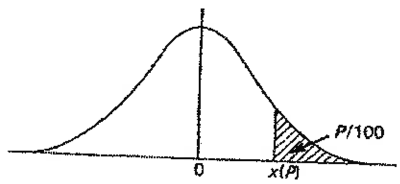
When $x > 3·3$ the formula $1-\Phi(x) \doteqdot \frac{e^{-\frac{1}{2}x^2}}{x\sqrt{2\pi}}\left[1-\frac{1}{x^2}+\frac{3}{x^4}-\frac{15}{x^6}+\frac{105}{x^8}\right]$ is very accurate, with relative error less than $945/x^{10}$.

TABLE 5. PERCENTAGE POINTS OF THE NORMAL DISTRIBUTION

This table gives percentage points $x(P)$ defined by the equation

$$\frac{P}{100} = \frac{1}{\sqrt{2\pi}}\int_{x(P)}^{\infty} e^{-\frac{1}{2}t^2}\,dt.$$

If X is a variable, normally distributed with zero mean and unit variance, $P/100$ is the probability that $X \geqslant x(P)$. The lower P per cent points are given by symmetry as $-x(P)$, and the probability that $|X| \geqslant x(P)$ is $2P/100$.



P	$x(P)$	P	$x(P)$	P	$x(P)$	P	$x(P)$	P	$x(P)$	P	$x(P)$
50	0·0000	5·0	1·6449	3·0	1·8808	2·0	2·0537	1·0	2·3263	0·10	3·0902
45	0·1257	4·8	1·6646	2·9	1·8957	1·9	2·0749	0·9	2·3656	0·09	3·1214
40	0·2533	4·6	1·6849	2·8	1·9110	1·8	2·0969	0·8	2·4089	0·08	3·1559
35	0·3853	4·4	1·7060	2·7	1·9268	1·7	2·1201	0·7	2·4573	0·07	3·1947
30	0·5244	4·2	1·7279	2·6	1·9431	1·6	2·1444	0·6	2·5121	0·06	3·2389
25	0·6745	4·0	1·7507	2·5	1·9600	1·5	2·1701	0·5	2·5758	0·05	3·2905
20	0·8416	3·8	1·7744	2·4	1·9774	1·4	2·1973	0·4	2·6521	0·01	3·7190
15	1·0364	3·6	1·7991	2·3	1·9954	1·3	2·2262	0·3	2·7478	0·005	3·8906
10	1·2816	3·4	1·8250	2·2	2·0141	1·2	2·2571	0·2	2·8782	0·001	4·2649
5	1·6449	3·2	1·8522	2·1	2·0335	1·1	2·2904	0·1	3·0902	0·0005	4·4172

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